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FOREST PLANTING LEAFLET.

NORWAY SPRUCE (Picea excelsa).

FORM AND SIZE.

The Norway spruce develops a straight, undivided trunk, with small slender branches which become somewhat drooping in later life. In the open the limbs, extending almost to the ground, form a well-shaped, conical crown. The forest-grown tree retains its conical form, but the crown is much more compact and is restricted to the upper portions of the trunk.

In size, the Norway spruce is not unlike our red spruce. Trees 80 to 100 feet high and 2 to 3 feet in diameter are common in Europe on good situations.

RANGE.

This species is not indigenous to North America, but is a native of northern Europe and Asia. It is almost invariably confined to cool, somewhat moist situations. In Europe it ranges from the shores of the Baltic and the lower mountain slopes of Scandinavia to the Alps, where it occurs at an altitude of 6,000 feet. Planting has widely extended the limits of its distribution. It was introduced into England in the sixteenth century and in the United States has been grown as an ornamental tree for many years.

The possible planting range in this country is not yet fully known. As a rule it will thrive throughout the entire Northeast and southward at the higher elevations. In the West favorable results have been attained only as far as the eastern part of the prairie region, and then only in the more protected localities. The great field for planting on a large scale is the cut-over land in the North, where the tree serves to provide for a future supply of wood suitable for pulp. It will adapt itself within certain limits to situations similar to those formerly occupied by our spruce forests, and it is in every way a superior tree.

HABITS AND GROWTH.

A rich, deep soil is not demanded by the Norway spruce, although it grows more rapidly on the better soils. The tree will grow well in a fresh, shallow, moderately porous soil, whether fertile or not, and will thrive with moderate moisture. It will not endure drought or a naturally dry soil. In common with our native spruces, this species is very shade enduring, forming dense stands which protect the soil and maintain forest conditions perfectly. The root system is shallow and not extensive.

The growth during the first decade is rather slow, but after this period there is a rapid increase in both height and diameter growth, followed by a gradual lessening. It is much more rapid in growth than our native spruce.

The Norway spruce is not subject to serious damage by insects or fungous diseases, but is seriously injured by drought, hot winds, and late frosts, while its shallow root system renders it liable to be thrown by the wind if exposed.

ECONOMIC USES.

In the United States little use has been made of the Norway spruce. The timber is light, soft, non-resinous, and fairly durable. It works well, splits easily, and seasons without serious warping.

Abroad, its largest uses are for construction timber, fuel, and paper pulp. Its utility for the last purpose should lead to extensive commercial planting in this country. The timber is excellent for general construction purposes as well, and may be used as a substitute for white pine.

Although the species is useful in protection forests, such as shelter-belts and windbreaks, it is not hardy enough for planting in the Middle West, where such forests are most necessary. In the East, however, it may be planted as a protection belt about exposed hardwood groves.

The rapid growth and graceful form of the Norway spruce in open situations has led to its wide use for shade and ornament.

METHOD OF PROPAGATION.

The Norway spruce is a heavy seeder, bearing a full crop every two or three years. The cones mature in September or October. They should be picked from the trees in the fall, and the seed extracted and stored in a cool, dry place during the winter. If carefully stored the seed can be kept from three to five years without serious loss of vitality.

If there are no cone-bearing trees in the vicinity, seed may be purchased. Samples sent to the Seed Laboratory of the Department of Agriculture will be identified and their germination per cent determined. Of fresh seed, fully 60 to 75 per cent should be fertile.

Home-grown seedlings should be used in the plantation when possible. Seedlings may be purchased, but it is better and cheaper to raise them on the tract. Bulletin 29 of the Forest Service gives instruction in all phases of nursery practice.

The nursery should be located on fertile, well-drained soil, preferably a sandy loam, and beds should be carefully prepared by working the ground thoroughly. The seed may be sown broadcast or in drills. Broadcast sowing gives the larger number of seedlings, but drilling is better because the beds can be more easily kept free from weeds.

The seed should be planted in shallow drills, 4 to 6 inches apart, and covered with no more than one-quarter of an inch of earth. Forty to 50 seeds per linear foot of drill should be used; the entire surface of the bed should then be packed firmly with a board or light roller.

One pound contains about 65,000 seeds; these will plant at least 1,500 linear feet of seed drills, and, if seed beds 4 by 12 feet in size are used, will occupy about 1,000 square feet of nursery space, including paths.

The planted seed should germinate within from three to five weeks, and during the first year should reach a height of $1\frac{1}{2}$ to $2\frac{1}{2}$ inches. The young trees require partial shade during the first summer, after which they can endure the full sunlight.

PLANTING.

When 2 years old, seedlings may be transferred to the permanent site. It is better, however, to transplant them at this age into nursery rows, and place them in the plantation when 3 years old. Although this will increase the cost of the plant material, it will often pay, since transplanted stock is more hardy and vigorous.

In planting, the seedlings should be spaced from 4 to 6 feet apart each way. The poorer the situation the greater the number of trees required to maintain forest conditions and the closer must be the planting. The form of the desired crop must also be considered.

In pure stands Norway spruce develops to excellent advantage, and is satisfactory for commercial planting on a large scale. It cleans its bole well in such stands, preserves the soil fertility, and makes a perfect forest floor. In many instances, however, it may well be mixed with other species. The best associates are white and red pine, European larch, and chestnut.

CULTIVATION AND CARE.

The trees require no cultivation after planting. Their great tolerance enables them to survive the shade of brush and weeds and eventually to overtop them.

The greatest enemy of the spruce is fire, which should be carefully excluded from plantations.

Spruce stands should never be severely thinned, as the shallow root system renders the trees liable to be thrown by the wind. This damage is especially great in exposed situations. In case such destructive agencies as insects or fungi appear, specimens, accompanied by an account of the character of the injury, should be sent to the Department of Agriculture for identification and recommendations for their control.

Approved.
James Wilson,
Secretary.

Washington, D. C., *November 24, 1906.*

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